

Table 6. Association Between Watching of Sesame Street (or Reading Rainbow) and Signs of Emerging Literacy In 3-Year-Old Preschoolers, By Poverty Status of Family

<u>Percentage showing sign of emerging literacy</u>			
<u>Sign of emerging literacy:</u>	<u>Poor Children</u>	<u>Non-poor Children</u>	<u>Total</u>
Tell connected story when pretending to read			
Children who watch Sesame Street (or Reading Rainbow)	56.3%	69.4%	66.6%
Children who watch neither	58.8%	66.7%	64.5%
All children	56.8%	69.0%	66.2%
Contingency coefficient	(.02)	(.02)	(.02)
Identify colors			
Children who watch Sesame Street (or Reading Rainbow)	53.4%	74.7%	70.1%
Children who watch neither	40.8%	69.1%	61.4%
All children	50.9%	73.8%	68.6%
Contingency coefficient	(.10)	(.05)	(.07)
Recognize some letters			
Children who watch Sesame Street (or Reading Rainbow)	68.7%	83.0%	79.9%
Children who watch neither	63.6%	71.9%	69.7%
All children	67.7%	81.3%	78.2%
Contingency coefficient	(.04)	(.10)	(.09)
Count to 10			
Children who watch Sesame Street (or Reading Rainbow)	74.3%	87.8%	84.8%
Children who watch neither	61.9%	81.6%	76.2%
All children	71.8%	86.8%	83.4%
Contingency coefficient	(.11)	(.07)	(.09)
Write and draw rather than scribble			
Children who watch Sesame Street (or Reading Rainbow)	53.4%	51.2%	51.7%
Children who watch neither	36.8%	45.9%	43.5%
All children	50.0%	50.4%	50.3%
Contingency coefficient	(.13)	(.04)	(.06)

**Table 7. Association Between Watching of Sesame Street and Signs of Emerging Literacy
In 3-Year-Old Preschoolers, By Poverty Status of Family**

<u>Percentage showing sign of emerging literacy</u>			
<u>Sign of emerging literacy</u>	<u>Poor Children</u>	<u>Non-poor Children</u>	<u>Total</u>
Tell connected story when pretending to read			
Children who watch Sesame Street	55.7%	69.3%	66.3%
Children who do not watch Sesame Street	60.9%	67.6%	65.9%
All children	56.8%	69.0%	66.2%
Contingency coefficient	(.04)	(.01)	(.00)
Identify colors			
Children who watch Sesame Street	52.9%	74.6%	69.8%
Children who do not watch Sesame Street	43.3%	70.8%	63.9%
All children	50.9%	73.8%	68.6%
Contingency coefficient	(.08)	(.03)	(.05)
Recognize some letters			
Children who watch Sesame Street	68.3%	82.8%	79.6%
Children who do not watch Sesame Street	65.4%	74.7%	72.4%
All children	67.7%	81.3%	78.2%
Contingency coefficient	(.03)	(.08)	(.07)
Count to 10			
Children who watch Sesame Street	74.0%	87.6%	84.6%
Children who do not watch Sesame Street	63.8%	83.4%	78.5%
All children	71.8%	86.8%	83.4%
Contingency coefficient	(.09)	(.05)	(.07)
Write and draw rather than scribble			
Children who watch Sesame Street	52.9%	51.2%	51.6%
Children who do not watch Sesame Street	39.8%	46.8%	45.0%
All children	50.0%	50.4%	50.3%
Contingency coefficient	(.11)	(.04)	(.05)

Table 8. Predicting Emerging Literacy in Four-Year-Old Children From Exposure To Educational TV Programs, Preschool Program Attendance, and Child and Family Characteristics (Linear Regression Analysis)

Dependent Variable: Number of accomplishments (out of six) shown by child

	<u>Poor Children</u>	<u>Non-Poor Children</u>	<u>All Children</u>
Mean number of accomplishments	3.50	4.54	4.26
Unweighted N	375	1,625	2,000
<u>Unstandardized regression coefficients</u>			
<u>Predictors</u>			
Watches Sesame Street (or Reading Rainbow)	.40 +	.09	.20 *
Has attended center-based program	.83 ***	.60 ***	.68 ***
Parents did not read to child in previous week	-.66 *	-.75 ***	-.83 ***
Parents read to child only once or twice in previous week	-.40 +	-.49 ***	-.47 ***
<u>Child's age and sex</u>			
Age in months	.06 *	.10 ***	.09 ***
Sex (female)	.37 *	.44 ***	.42 ***
<u>Family SES, Language Status</u>			
Parent education level	.41 ***	.13 ***	.19 ***
Family income	.07	.05 ***	.07 ***
Mother's primary language Spanish	-.72 *	-.92 ***	-.79 ***
Mother's primary language other non-English language	-1.18 *	.27	-.38
<u>Race/Ethnicity</u>			
Black	.30	-.00	.09
Hispanic	-.14	-.40 **	-.36 **
Asian	.39	-.36	-.02
<u>Children in Household</u>			
Oldest or only child	.16	.26 ***	.24 ***
Number of young children in HH	-.18 +	-.02	-.09 *
<u>Parents in Household</u>			
Mother only	.04	.09	.01
Mother-Stepfather	.17	.05	.09
Father only	1.25 +	-.58 **	-.25
Neither biological parent	.17	-.83 ***	-.55 **
<u>Mother's Employment</u>			
Full-time, full-year	-.02	.10	.16 +
Part-time, part-year	.45 *	.13	.25 ***
Intercept	2.54 ***	3.42 ***	3.15 ***
R	.55 ***	.50 ***	.54 ***
Adjusted R squared	.26	.24	.29

Table 9. Predicting Emerging Literacy in Three-Year-Old Children From Exposure To Educational TV Programs, Preschool Program Attendance, and Child and Family Characteristics (Linear Regression Analysis)

Dependent Variable: Number of accomplishments (out of five) shown by child

	Poor <u>Children</u>	Non-Poor <u>Children</u>	All <u>Children</u>
Mean number of accomplishments	2.97	3.61	3.47
Unweighted N	302	1,610	1,912
<u>Unstandardized regression coefficients</u>			
<u>Predictors</u>			
Watches Sesame Street (or Reading Rainbow)	.33	.18 *	.22 **
Has attended center-based program	-.04	.23 ***	.17 **
Parents did not read to child in previous week	-1.07 ***	-.85 ***	-.98 ***
Parents read to child only once or twice in previous week	-.66 **	-.59 ***	-.58 ***
<u>Child's age and sex</u>			
Age in months	.09 ***	.07 ***	.07 ***
Sex (female)	.27	.40 ***	.38 ***
<u>Family SES, Language Status</u>			
Parent education level	.45 ***	.16 ***	.22 ***
Family income	-.06	.03 *	.03 *
Mother's primary language Spanish	-.83 *	-.54 **	-.67 ***
Mother's primary language other non-English language	-1.14	-.41	-.44 +
<u>Race/Ethnicity</u>			
Black	-.30	.02	-.10
Hispanic	.09	-.18	-.07
Asian	-.75	.15	.03
<u>Children in Household</u>			
Oldest or only child	.52 **	.31 ***	.36 ***
Number of young children in HH	-.00	-.06	-.06
<u>Parents in Household</u>			
Mother only	.23	-.03	.01
Mother-Stepfather	-.02	.21	.16
Father only	-.05	-.14	-.08
Neither biological parent	.31	-.25	-.24
<u>Mother's Employment</u>			
Full-time, full-year	.16	-.02	.04
Part-time, part-year	.17	.12 +	.16 *
Intercept	2.71 ***	2.94 ***	2.87 ***
R	.54 ***	.49 ***	.52 ***
Adjusted R squared	.24	.23	.26

+ $p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

Table 10. Predicting Ability to Read Storybooks and Receipt of Special Help for Reading Problems in Early Elementary Schoolchildren From Exposure To Sesame Street, Preschool Program Attendance, and Child and Family Characteristics (Logistic Regression Analysis)

Predictors:	Indicator					
	Can Read Storybooks			Gets Help for Reading		
	1st and 2nd Graders	1st Graders	2nd Graders	1st and 2nd Graders	1st Graders	2nd Graders
<i>Unstandardized Regression Coefficients</i>						
Watched Sesame Street	.66 ***	.70 ***	.58 *	-.34 **	-.17	-.45 **
Attended center-based program	.04	.15	-.24	-.01	-.22 +	.20
<u>Child's age and sex</u>						
Age in years	.89 ***	.60 ***	.17	.26 ***	.27 *	.35 **
Sex (female)	.53 ***	.45 ***	.72 **	-.51 ***	-.64 ***	-.40 ***
<u>Family SES, Language Status</u>						
Parent education level	.11 +	.11	.13	-.23 ***	-.21 **	-.23 ***
Family income	.07 **	.07 **	.03	-.06 **	-.06 *	-.05 *
Mother's primary language Spanish	-.63 **	-.78 *	-.45	-.42 +	.03	-.75 *
Mother's primary language other non-English language	-.11	-.16	-.07	.13	.55	-.20
<u>Race/Ethnicity</u>						
Black	-.27 +	-.28	-.50	-.16	-.15	-.20
Hispanic	-.43 *	-.32	-1.00 **	.15	.04	.20
Asian	-.11	-.06	-.65	-.63 +	-2.22 *	.17
<u>Children in Household</u>						
Oldest or only child	.22 +	.29 *	-.02	-.23 **	-.12	-.27 *
Number of young children in HH	.03	.11	-.16	.03	.01	.09
<u>Parents in Household</u>						
Mother only	-.07	-.04	-.23	.12	-.12	.39 *
Mother-Stepfather	-.54 **	-.75 **	.11	.14	.15	.17
Father only	-.11	-.44	.12	.08	-.07	.01
Neither biological parent	-.93 ***	-1.07 ***	-.57	.29	-.04	.57 +
<u>Mother's Employment</u>						
Full-time, full-year	.05	.07	.25	-.09	-.03	-.16
Part-time, part-year	.07	.17	-.22	-.13	-.25 +	.03
Intercept	-5.66 ***	-4.20 ***	.63	-1.02 *	-.84	-2.14 *
R	.47 ***	.40 ***	.44 ***	.31 ***	.30 ***	.31 ***

+ p < .10; * p < .05; ** p < .01; *** p < .001

Table 10 (continued). Predicting Ability to Read Storybooks and Receipt of Special Help for Reading Problems in Early Elementary Schoolchildren From Exposure To Sesame Street, Preschool Program Attendance, and Child and Family Characteristics (Logistic Regression Analysis)

Predictors:	Indicator					
	Can Read Storybooks			Gets Help for Reading		
	1st and 2nd Graders	1st Graders	2nd Graders	1st and 2nd Graders	1st Graders	2nd Graders
<i>Odds Ratios</i>						
Watched Sesame Street	1.93 ***	2.01 ***	1.79 *	.72 **	.85	.64 **
Attended center-based program	1.04	1.16	.79	.99	.81 +	1.22
<u>Child's age and sex</u>						
Age in years	2.44 ***	1.83 ***	1.19	1.30 ***	1.31 *	1.41 **
Sex (female)	1.70 ***	1.57 ***	2.05 **	.60 ***	.53 ***	.67 ***
<u>Family SES, Language Status</u>						
Parent education level	1.12 +	1.12	1.14	.79 ***	.81 **	.79 ***
Family income	1.07 **	1.08 **	1.03	.95 **	.94 *	.95 *
Mother's primary language Spanish	.53 **	.46 *	.64	.66 +	1.03	.47 *
Mother's primary language other non-English language	.90	.85	.94	1.13	1.73	.82
<u>Race/Ethnicity</u>						
Black	.76 +	.75	.61	.85	.86	.82
Hispanic	.65 *	.73	.37 **	1.16	1.04	1.22
Asian	.90	.94	.52	.53 +	.11 *	1.19
<u>Children in Household</u>						
Oldest or only child	1.25 +	1.34 *	.98	.80 **	.89	.77 *
Number of young children in HH	1.03	1.12	.85	1.03	1.01	1.09
<u>Parents in Household</u>						
Mother only	.94	.96	.79	1.13	.89	1.48 *
Mother-Stepfather	.58 **	.47 **	1.12	1.15	1.16	1.18
Father only	.90	.65	1.13	1.08	.93	1.01
Neither biological parent	.40 ***	.34 ***	.57	1.33	.96	1.77 +
<u>Mother's Employment</u>						
Full-time, full-year	1.06	1.08	1.28	.91	.97	.86
Part-time, part-year	1.07	1.18	.81	.88	.78 +	1.03

+ p < .10; * p < .05; ** p < .01; *** p < .001

**Table 11. Sample characteristics of the School Readiness Component
of the 1993 National Household Education Survey**

	Unweighted Number of Children	Weighted Percentages
Total sample	10,888	100.0%
Enrollment status		
Preschoolers	4,423	42.8%
Kindergartners	2,126	19.7%
Early elementary students	4,277	37.0%
Home schoolers	62	0.5%
Age (as of December 30, 1992)		
3	1,917	19.4%
4	2,055	18.9%
5	2,024	19.1%
6	2,057	18.7%
7	2,098	18.9%
8	711	4.8%
9	26	0.2%
Sex		
Male	5,584	51.2%
Female	5,304	48.8%
Race/ethnicity		
White, non-Hispanic	8,133	74.0%
Black, non-Hispanic	1,526	16.2%
Hispanic	1,749	12.0%
Asian/Pacific Islander	267	2.3%
Parents' highest education		
Less than high school	814	8.6%
High school diploma	3,429	33.9%
Some college	3,521	32.2%
College degree	1,582	12.9%
Graduate school	1,542	12.4%
Household income		
\$15,000 or less	2,070	27.2%
\$15,001 to \$25,000	1,604	18.6%
\$25,001 to \$35,000	2,116	15.6%
\$35,001 to \$50,000	2,429	18.3%
\$50,001 to \$75,000	1,643	12.4%
More than \$75,000	1,026	8.0%
Region of residence		
Northeast	1,869	19.1%
South	4,082	34.2%
Midwest	2,443	24.1%
West	2,494	22.5%

RUNNING HEAD: Science on Saturday Morning

Science on Saturday morning:
Children's perceptions of science in educational and
non-educational cartoons

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Abstract

The Federal Communications Commission is considering whether to strengthen the implementation of the Children's Television Act of 1990, which requires broadcasters to air educational and informational programs for children. Some broadcasters have opposed such measures, arguing that not enough children will watch educational programs. This argument assumes that children distinguish between educational and non-educational programs, find educational programs less appealing, and consequently are unlikely to watch. The present study tests these assumptions directly, through a comparison of two animated programs set in prehistoric times, Cro (an educational program about technology) and The Flintstones (a non-educational program). Results indicated that Cro's technology content was salient to children but, contrary to the above assumptions, children did not distinguish between the programs on the basis of their educational content, and both programs were highly appealing.

Science on Saturday morning:

Children's perceptions of science in educational and
non-educational cartoons

Television plays a major role in the lives of children. Although estimates of the amount of time children spend viewing television vary widely (from 11 to 28 hours per week), numerous studies indicate that American children spend more time watching television than in any other activity except sleeping (e.g., Anderson, Field, Collins, Lorch, & Nathan, 1985; Huston, Watkins, & Kunkel, 1989; Huston, Wright, Rice, Kerkman, & St. Peters, 1987). A large body of research has also demonstrated that television can have significant effects on children, either educational (e.g., Ball & Bogatz, 1970; Bogatz & Ball, 1972; Chen, 1994; Fisch, Esty, & Hall, 1994) or detrimental (e.g., Paik, 1993; Surgeon General's Scientific Advisory Committee on Television and Social Behavior, 1972).

The ubiquity of television in children's lives has provided the impetus for more than 25 years of debate over the need for public policy to ensure that broadcasters provide programming that will meet the needs of a child audience. One outcome of this debate was the passage of the Children's Television Act of 1990. Among the provisions of the Act was the requirement that broadcasters must serve "the educational and informational needs of children through the licensee's overall programming, including programming specifically designed to serve such needs" (Sec. 103 [a] [2]).

The response to the Act was not a sudden increase in the production of educational programming aimed at children. Although a station survey conducted by the National Association

of Broadcasters reported that the average amount of children's educational programming had risen from slightly more than two hours per week in 1990 to 3.6 hours in 1993, the Federal Communications Commission (FCC) concluded from a cursory review of license renewal applications that the reliability of these figures was questionable (FCC, 1995, p. 6318).¹ Indeed, a very different picture was presented by Condry, Scheibe, Bahrt, and Potts (1993); these researchers conducted a content analysis of children's television, and found only one educational program airing on commercial stations (i.e. stations other than PBS) in 1992. Although 1993 saw the introduction of four new educational television series on commercial television -- three series about science (Cro, Beakman's World, and Bill Nye the Science Guy) and one about geography (Where on Earth Is Carmen Sandiego) -- the overall number of educational programs remained fairly low.

Part of the reason for the discrepancy between the data from the NAB study and Condry et al. -- as well as the relatively small amount of substantive educational programming found on commercial television -- may lie in the FCC's definition of "educational programming." The FCC broadly defined "educational programming" as carrying content that "furthers the positive development of children 16 years of age and under in any respect, including the child's intellectual/cognitive or social/emotional needs" (FCC, 1991, p. 2121). Contrast this with the stricter definition used by Condry et al. (1993):

A significant portion of the program is devoted to teaching information that the children in the audience are not likely to already know (e.g., the alphabet, vocabulary, historical or scientific information, applied information for everyday life) or demonstrating skills or crafts. (Condry et al., 1993, p. 5)

Under the broad definition of "educational programming" currently used by the FCC, some broadcasters have responded to the Act, not by creating new educational programming, but by redefining existing entertainment programming as educational (Kunkel & Canepa, 1994). In a few well-publicized cases, this was taken to extremes; for example, The Jetsons was presented as educational because it presents life in the 21st century, and The Flintstones and G.I. Joe were cited for containing pro-social themes, while adult-oriented news programs and game shows such as Wheel of Fortune have been claimed as educational children's programming as well (Andrews, 1993; Kunkel & Canepa, 1994).

The FCC is not unaware of either the lack of substantive educational programming or its potential causes. In 1993, the FCC stated that "it seems clear that Congress intended...to increase the amount of educational and informational programming aimed expressly at the child audience...[but] we do not believe that [the current] level of performance is, in the long term, consistent with the objectives underlying the [Children's Television Act]" (FCC, 1993, p. 1842). The FCC announced its intention to strengthen its implementation of the Act, and sought comment on the possibility of: (1) narrowing the definition of "educational and informational programming" and (2) establishing quotas for the amount of educational programming to be aired, and its enforcement (Andrews, 1993). More recently, the FCC voted to further study several proposals for strengthening the Act (Cooper, 1995), although support among the FCC commissioners is far from unanimous (Stern, 1995). At the time of this writing, the FCC has solicited and is in the process of receiving public comment on the Act and its guidelines (FCC, 1995).

As one might expect, broadcasters have been wary of further governmental regulation of

their programming, and many have opposed strengthening the guidelines of the Act. At a recent FCC hearing on children's television, one station manager argued that "if television stations are straightjacketed and forced by government fiat to broadcast unappealing, but educational programs, the audience will evaporate" (Walker, 1994, p. 6). Similarly, Aufderheide and Montgomery (1994) quote a syndicator as complaining that "the FCC is telling you that you have to put boring TV on. The primary focus has to be educational, not entertaining. You know kids, they don't want to go to school all week. If they don't want to watch it, who's gonna make 'em?" (p. 25).

Such arguments seem to rest on the assumption that education and entertainment are, somehow, mutually exclusive. Although some proponents of this view acknowledge rare exceptions to the rule, such as Beakman's World (Walker, 1994), they nevertheless assume that educational programs will be appealing to a narrower audience of children and, thus, attract fewer (if any) viewers. In other words, they assume that children: (1) distinguish between programs that are intended to be educational and programs that are not, (2) find educational television programs to be unappealing, and (3) consequently choose not to watch educational programs.

Yet, these tacit assumptions have never been tested empirically, so their validity has remained questionable. The present study is intended to provide a direct, empirical test of these issues, through a comparison of children's perceptions of educational and non-educational television series. In particular, the study examines whether children distinguish between educational and non-educational television programs, their recall and perceptions of the educational content in an educational program, and the relative appeal of educational and non-educational programs.

To be conservative, this paper adopts the strict definition of "educational television programming" used by Condry et al. (1993), presented above. The two television programs used in the study (The Flintstones and Cro) are, on the surface, very similar. Both are humorous, half-hour animated cartoons. Both air on commercial television. And both present a cast of characters in a prehistoric setting.

Yet, the two series differ in educational content. The Flintstones would not be considered educational under the definition posed by Condry et al. However, even under this strict definition, Cro would. Produced by the Children's Television Workshop (CTW) and broadcast on Saturday mornings on ABC, Cro is a series about technology aimed at 6- to 11-year-old children. Cro presents the adventures of an 11-year-old Cro-Magnon boy, his Neanderthal "family," and the talking woolly mammoths who are their friends, as they use a variety of scientific concepts and simple machines to overcome the obstacles of their prehistoric world. The main body of each show is set in the Ice Age, with framing sequences (starring a Latina scientist, an African-American boy, and a well-preserved mammoth) set in the present.

Cro was designed to blend into the Saturday-morning viewing environment, but to educate as well as entertain. The series' three primary educational goals are:

- o To entertain and reach a large audience on network television, while helping increase children's familiarity with and interest in basic scientific and technological principles through an introduction to the workings of familiar machines, gadgets, and simple tools;
- o To help stimulate children's interest in science and technology by showing that they are not abstractions but integral parts of daily life; and

- o To work to convince youngsters that discovering the workings of science and technology can be great fun.

Each episode of Cro centers on a different science concept or technological device, such as the features of wings that allow an airplane to fly. Two summative studies have demonstrated that Cro exerts a significant impact on children's understanding of and interest in technology (Fay, Yotive, Fisch, Teasley, McCann, Garner, Ozaeta, Chen, & Lambert, 1995; Fisch, Goodman, McCann, Rylander, & Ross, 1995).

Like Cro, The Flintstones presents whimsical gadgets (e.g., an elephant's trunk that serves as a vacuum cleaner). Unlike Cro, however, the devices in The Flintstones are fanciful and would not work in real life. Thus, the devices and "science" presented in The Flintstones can better be considered "pseudo-science" -- that is, unrealistic devices that do not obey physical laws or "scientific" practices that have the trappings of science but are not accurate.

Because Cro and The Flintstones share a great deal of surface similarity but are so different educationally, they can provide a good test of broadcasters' assumptions regarding educational programming. The present study examines the relative appeal of these two programs for children, children's perceptions of the similarities and differences between them, and their perceptions of science in each program.

Method

Sample. The sample consisted of 77 children, 41 girls and 36 boys. Children were taken from the second (mean age = 7 years, 11 months), fourth (mean age = 10 years, 0 months), and fifth (mean age = 11 years, 0 months) grades of an inner-city, public elementary school in

Manhattan, NY. The ethnic composition of the sample was 90% African-American, 9% Latino, and 1% White.

To assess the children's viewing habits, they were asked whether they had seen each of the following series on television: Cro, The Flintstones, Marsupilami, Cadillacs and Dinosaurs, The X-Men, and Bobby's World. The relative numbers of children who had watched each series was consistent with the series' Nielsen ratings and the longevity of The Flintstones. Thus, the television viewing habits of the sample appeared to be representative of the larger population of American children.

Children were also asked, more specifically, how often they had watched Cro and The Flintstones on television before. Prior viewership was higher for The Flintstones than Cro. In all, 73% reported having watched The Flintstones "a whole lot (more than 20 times)", 15% reported watching it "a lot (6-20 times)," 7% had watched it "a few times (1-5 times)," and 5% had never seen it. By contrast, 18% had watched Cro "a whole lot," 12% reported watching it "a lot," 23% had seen it "a few times," and 47% had never watched it.

Materials. Children were presented with three television programs on videotape. Two of the programs were episodes of Cro and one was an episode of The Flintstones.

The first episode of Cro (the "Wheels" program) showed the characters developing a wheeled device to transport a mammoth who'd broken two of his legs. The technology content centered on finding the easiest and most efficient method of reducing friction: pushing the mammoth across the ground; pushing him across rollers that constantly must be replaced in front of him; creating a platform that rolled on two permanent rollers; and using a pair of wheels that would allow him to steer and brake.

In the second episode of Cro (the "Flight" program), the characters invented a rudimentary glider. The technology content of the episode consisted primarily of the characters' learning that: air exists and wind can hold things in the air; wings must have the proper size, shape, and sturdiness; a vertical stabilizer allows a glider to fly straight; and a rudder allows it to turn.

In the Flintstones episode, Fred Flintstone had a dream in which the infants Pebbles and Bamm Bamm became singing stars. The episode contained no technology content of the sort presented in Cro. However, it did include several instances of pseudo-science: cars that are powered by the driver's feet running through the floor; a stone contract that is signed with a chisel; and a psychiatrist who checks Bamm Bamm's knee reflexes and immediately diagnoses both Bamm Bamm and Pebbles as suffering from "mass-media transactional hypnosis."

Procedure. The study was conducted over a three-day period. On Day 1, children were shown the Cro Wheels episode. On Day 2, they viewed the Cro Flight episode. On Day 3, they viewed The Flintstones.

On Days 2 and 3, immediately after viewing each program, the children rated its appeal on a five point scale: "Great" (5), "Good" (4), "OK" (3), "Not So Good" (2), or "Terrible" (1). Next, approximately 1/2 of the children were then interviewed in groups of two to four. Each interview asked children to recall the story from that day's program, compare it to the programs they had seen on the previous days (similarities and differences), and decide whether the program contained any "science" (since second graders might not understand "technology" as relating to simple machines) and, if it did, to give examples of the "science" they had seen.

Results

Appeal. Both of the programs tested (the Cro Flight episode and The Flintstones) were rated as highly appealing, with both rated between "Good" and "Great" on average. The mean appeal rating for Cro was 4.33 and the mean rating for The Flintstones was 4.54 on a five-point scale.

Free recall. In examining children's free recall of the stories of the Cro Flight episode and The Flintstones, our primary interest was in whether children would spontaneously mention the devices shown in the two programs, the proces of inventing shown in Cro, or the instances of pseudo-science shown in The Flintstones.

As Table 1 indicates, significantly more children spontaneously mentioned the devices or inventing in Cro than in The Flintstones ($\chi^2 = 37.38$, $p < .001$). Approximately 2/3 of the children mentioned these aspects of Cro. For example, one second grader explained that a flimsy, overly long wing was not as good as a shorter wing because "the stick [wing] is heavier and smaller." A fifth grader explained the use of the rudder on the device: "[the characters] made the wing of an airplane and the back of the airplane like a motor boat... the back [rudder] sticks up like a motor boat and controlled the front.... If you couldn't control it, it would go right or left [uncontrollably]."

Table 1 about here

By contrast, only two children mentioned the psychiatrist's examination in The Flintstones. For example, one second grader recalled that "the doctor came to see how they sing and they

didn't even talk. The doctor hit [Bamm Bamm] on the knee and he kicked them. The doctor said, 'Ah' and they opened their mouth." None of the children spontaneously mentioned the gadgets shown in the program.

Direct comparison of Cro and The Flintstones. Children were asked directly for similarities and differences between Cro and The Flintstones, to determine whether they perceived the two series as different because of the educational/technology content of Cro.

When asked for similarities, almost all of the children's responses centered on their prehistoric settings or humorous animated formats. Of the 48 children who were asked, only three responded that the characters in both series "solved problems," approaching the problem-solving context in which Cro's technology content is set.

Similarly, most (76%) of the differences that children found between the series concerned plot- or format-related differences rather than educational/technological features (e.g., different characters, animals, or clothes). In fact, although 26% of the children's responses concerned differences in technology, only one of these responses referred to the fact that Cro "invents things"; the remainder of the responses concerned devices such as prehistoric televisions, cars, lawnmowers, or lights, that were shown in The Flintstones but not Cro.

Thus, when asked to make explicit comparisons between Cro and The Flintstones, children's responses did not typically rely upon the educational/technology content of Cro.

"Science." Because the primary educational focus of Cro is on science and technology, the children were asked directly whether "science" was present in each of the two programs. Most children said that "science" was present in both (Table 2). There was no statistically significant difference between the number of children who said that there was "science" in the

two programs ($\chi^2 = 2.01$, N.S.).

Table 2 about here

However, significant differences between the programs emerged when we examined the nature of the examples of "science" that the children provided (Table 3). After each show, most of the examples children provided were pseudo-science rather than actual science, indicating that children do not differentiate between real and pseudo-science. This is consistent with past research that has shown that children -- and even college students -- do not always hold clear and accurate conceptions of what "science" is (e.g., Crelinsten, de Boerr, & Aikenhead, 1991; Fisch, Yotive, McCann, Garner, Chen, & Ozaeta, in preparation; Fleming, 1988).

Nevertheless, those children who offered examples of "science" were approximately three times as likely to offer realistic examples of devices or technology in Cro than in The Flintstones ($\chi^2 = 4.65$, $p < .05$). In all, 45% of the children's examples regarding Cro concerned devices and technology; for example, one fifth grader said that "they take leaves and sticks and they put it on the back of a glider to make it turn.... [E: Why is that science?] Because they are building and doing." By contrast, children almost invariably pointed to pseudo-science in giving examples regarding The Flintstones; for example, a fifth grader explained, "They teach you how to use animals for machines...an elephant for a shower, you can use a tiger for a pet. [E: Why is that science?] Because you have someone to protect you when you are in your house. [E: What makes that science?] You can put poison in his teeth and have him or her bite you." (Other examples of pseudo-science included the fanciful medical examinations, "historical" settings, and

animals in both The Flintstones and Cro, and an Ice Age mammoth's being frozen until the twentieth century in Cro.)

Table 3 about here

Thus, children more often identified examples of actual science or technology when discussing Cro, although there was no significant difference in the degree to which they saw the two programs as containing "science."

Discussion

To contextualize the present data properly, let us return to the assumptions that underlie broadcasters' argument that children are disinclined to watch educational television: (1) children distinguish between programs that are intended to be educational and programs that are not, (2) they find educational television programs to be unappealing, and (3) they consequently choose not to watch educational programs.

The present data, along with prior research, support Cro's being classified as educational. Prior research has shown exposure to Cro to result in significant increases in children's understanding of and interest in technology (Fay, et al., 1995; Fisch, et al., 1995). The present data are consistent with these findings; in this study, Cro's technology content was sufficiently salient that 2/3 of the children spontaneously mentioned its devices during free recall and approximately 1/2 of their examples of science in Cro concerned its devices and technology.

Nevertheless (and contrary to broadcasters' first assumption, above), children did not see the educational content of Cro as distinguishing it from The Flintstones. They did not cite it as a difference between the two series, nor did they see Cro as more of a "science series" than The Flintstones.

Regarding broadcasters' second assumption -- that children find educational series unappealing -- the data indicate that the children in this study found both Cro and The Flintstones to be appealing. Both received appeal ratings between "good" and "great" on average. This is consistent with prior research that has shown Cro to have high appeal (e.g., Fay, et al., 1995), as well as research on other, more explicitly educational television series, such as Square One TV, which also has shown high appeal among school-age children (e.g., Fisch, McCann, Cohen, Body, Hoffman, & Seyfert, 1992). Indeed, research on Square One TV has often found school-age children explaining that they liked a particular show or segment because they could learn from it (e.g., Hall, Miller, & Fisch, 1990).

This study did not test broadcasters' third assumption -- that children choose not to watch educational programs -- directly; however, the high appeal of Cro suggests that children would choose to watch it. The most recent Nielsen rating data for Cro also cannot answer this question directly, because at the time of this writing, Cro most recently aired opposite Beakman's World (another educational series) and sports programming (which is not aimed exclusively at children). Nevertheless, the recent Nielsen data for six- to eleven-year-olds indicate that Cro's target age group chose to watch Cro over other series by a nearly two-to-one margin; an average of more than 1,500,000 children watched Cro every week between December, 1994 and July, 1995 (Nielsen Media Research, 1995). Indeed, even when Cro aired opposite non-educational

children's programming in 1993 and 1994, Cro consistently received higher Nielsen ratings among six- to eleven-year-olds than either The Little Mermaid or Marsupilami (both of which were non-educational programs on CBS), although Cro was not as highly rated as the Fox Network's Dog City (Nielsen Media Research, 1993, 1994). Thus, Cro's ratings were competitive against both educational and non-educational programs, indicating that children are not inherently biased against watching educational programs.

Overall, then, while broadcasters have argued that children will not watch educational television series, none of the assumptions that underlie this argument show empirical support. Children do not necessarily make a firm distinction between educational and non-educational programming (even if they learn or benefit from the educational programs), nor do they necessarily find educational programs to be less appealing.

Certainly, we would not conclude that all educational television series are highly appealing, any more than we would argue that all non-educational programs are highly appealing. However, the present data make it clear that education and entertainment are not mutually exclusive; this is a false dichotomy, as the FCC has acknowledged in response to comments from parties such as CTW, Disney, CBS, and the NAB (FCC, 1995, pp. 6324, 6328). When children watch television, they do not necessarily categorize programs as "education" or "entertainment." A television series can be both educational and entertaining. Indeed, it is likely that it will be more effective if it is.

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